

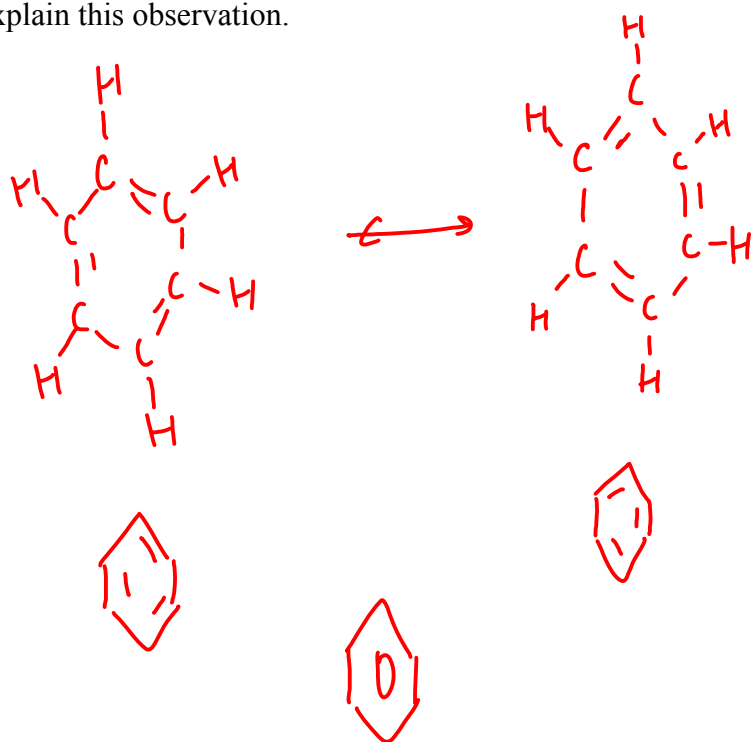
# Resonance

Draw the possible resonance structures for following molecules or ions. Through formal charges on atoms, determine which is the most likely structure.

SO <sub>2</sub>	$\begin{array}{c} \bar{O} - \bar{S} = \bar{O} \\ \bar{-} \quad +1 \quad 0 \end{array} \longleftrightarrow \begin{array}{c} \bar{O} = \bar{S} - \bar{O} \\ 0 \quad +1 \quad -1 \end{array} \quad \begin{array}{c} \bar{O} - \bar{S} - \bar{O} \\ \bar{-} \quad +2 \quad \bar{-} \end{array}$ <p style="text-align: center;">Best</p>
NO <sub>2</sub> <sup>-</sup>	$\left[ \begin{array}{c} \bar{O} - \bar{N} = \bar{O} \\ \bar{-} \quad 0 \quad 0 \end{array} \right]^{-} \longleftrightarrow \left[ \begin{array}{c} \bar{O} = \bar{N} - \bar{O} \\ 0 \quad 0 \quad -1 \end{array} \right]^{-} \quad \left[ \begin{array}{c} \bar{O} - \bar{N} - \bar{O} \\ \bar{-} \quad +1 \quad \bar{-} \end{array} \right]^{-}$ <p style="text-align: center;">Best</p>
SCN <sup>-</sup>	$\left[ \begin{array}{c} \bar{S} - C \equiv N \\ \bar{-} \quad 0 \quad 0 \end{array} \right]^{-} \quad \left[ \begin{array}{c} \bar{S} - C = \bar{N} \\ \bar{-} \quad +1 \quad -1 \end{array} \right]^{-} \quad \left[ \begin{array}{c} \bar{S} = C = \bar{N} \\ 0 \quad 0 \quad -1 \end{array} \right]^{-}$ <p style="text-align: center;">Best</p>
NO <sub>3</sub> <sup>-</sup>	$\left[ \begin{array}{c} \bar{O} - \bar{N} = \bar{O} \\ \bar{-} \quad +1 \quad 0 \\   \\ \bar{O} \\ \bar{-} \end{array} \right]^{-} \longleftrightarrow \left[ \begin{array}{c} \bar{O} = \bar{N} - \bar{O} \\ \bar{-} \quad   \quad \bar{-} \\ \bar{O} \\ \bar{-} \end{array} \right]^{-} \longleftrightarrow \left[ \begin{array}{c} \bar{O} - \bar{N} - \bar{O} \\ \bar{-} \quad    \quad \bar{-} \\ \bar{O} \\ \bar{-} \end{array} \right]^{-} \quad \left[ \begin{array}{c} \bar{O} - \bar{N} - \bar{O} \\ \bar{-} \quad +2 \quad \bar{-} \\   \\ \bar{O} \\ \bar{-} \end{array} \right]^{-}$ <p style="text-align: center;">Best</p>
HNO <sub>3</sub>	$\begin{array}{c} \bar{O} \quad \bar{O} \quad +1 \quad \bar{O} \\   \quad   \quad   \\ H - \bar{O} - N = \bar{O} \\   \\ \bar{O} \\ \bar{-} \end{array} \quad \begin{array}{c} \bar{O} \quad +1 \quad \bar{O} \\   \quad   \quad   \\ H - \bar{O} - N - \bar{O} \\    \\ \bar{O} \\ \bar{-} \end{array} \quad \begin{array}{c} +1 \quad +1 \quad \bar{O} \\   \quad   \quad   \\ H - \bar{O} = N - \bar{O} \\   \\ \bar{O} \\ \bar{-} \end{array}$ <p style="text-align: center;">Best</p>

SO <sub>3</sub>	
SO <sub>4</sub> <sup>2-</sup>	
O <sub>3</sub>	

Use the concept of resonance to explain why all six C—C bonds in benzene, C<sub>6</sub>H<sub>6</sub>, are equal in length. Benzene's structure has all six carbons arranged in a ring structure. These C—C bonds are shorter than C—C single bonds, but longer than C=C double bonds. Use resonance to explain this observation.



all bonds have partial single & double bond character. So, this shortens the bonds (compared to single bonds), but still leaves the bonds longer than a regular C=C double bond.